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Forest planting
in
Virginia

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A paper read at the Third Annual Meeting
of the Pennsylvania Forestry Association,

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President of the Association.

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FOREST PLANTING IN VIRGINIA.

FORESTRY, as practiced in Scotland, France and Germany, treats principally of the oversight of artificial woodlands, and the further extension of such plantations. In America we have 400 million acres of natural forest, and none of artificial: 400 millions seems a large area—but of this, from five to seven million acres are annually burned over by forest fires, and the rest is being cut so rapidly and wastefully that it will all be gone before a new crop of trees of saw-log dimensions can be grown; for to develop a White Pine tree to saw-log size takes eighty years, and to develop a Long Leaved Southern Pine to saw-log size takes one hundred years. Now what is to be done? Why curtail, under State and National legislation, the wholesale destruction of our national forests till new forests are planted and developed.

Artificial forest development in Europe is the main feature. *Natural forest PRESERVATION* in America should be the main feature; planting being secondary.

Each man, however, who enters practically into forest work must take it up as determined by the conditions surrounding the district in which he proposes to operate. Now it happens that the personal work presented to me, is not to preserve natural forests on mountain sides, but to endeavor to build up an artificial low-land forest.

In 1870 the Senior of my Firm, who had for a long life been a collector and planter of trees for ornamental purposes, till he had established a noted collection, conceived the plan of planting trees for Forest purposes, on a large area of old farm land in Eastern Virginia, where, on the lower Chesapeake, we held about 5000 acres. The meteorological conditions of the locality may be briefly described by stating that the annual rainfall is 49 inches. The relative humidity, both during summer and winter, 73. The maximum temperature 103°, the minimum 1°

above zero. The wind in summer southwest, in winter from the north.

Of this tract about two-thirds was in natural and second growth Pine, with some hard wood interspersed. He decided to plant the open farm fields, and follow upon the stump land as the forest was cut off. Experience had made very clear to us the wonderful reproductive capacity of the soil of tidewater Virginia, in re-clothing itself with the natural Pine of that region—*Pinus taeda*—Loblolly Pine or old Field Pine, two variations of which are known to the wood cutter—the Rosemary and the Fox-tail. Still we thought it might be profitable to establish forests of varieties, both evergreen and deciduous, not common to that section, which would promise to be more profitable than the ordinary Virginia Pine. The varieties of native deciduous trees found there comprise the Chestnut, Walnut, Ash, Oak and many others, but rarely occurring in forests of one variety—always mixed; nature grows them that way. So we concluded to try the experiment of Forest planting, which, if it were not profitable to us or our successors, might at least serve as a guide to outline the future course of others in that portion of Virginia. Accordingly, in 1870 we began operations, and in 1871 planted a field of 100 acres with the nuts of Black Walnut, depositing the nuts at one foot apart in open furrows drawn at 8 feet apart. We followed this by planting 8 acres with the nuts of Chestnut.

The next year, 1872, we continued planting both tree seed and seedlings. Of seedlings we purchased and set out the following: 30 thousand Locusts—*Robinia pseudacacia*; 5 thousand Cypress—*Taxodium distichum*; 5 thousand European Larch—*Larix Europea*. These we planted in solid blocks, 4 x 4 feet apart, intending that they should prune themselves.

In 1873 we planted tree seeds as follows: 4 bushels Locusts, 12 bushels Chestnuts, $\frac{1}{2}$ bushel Larch.

In 1874 we continued the seed planting, putting in 150 bushels Walnuts—*Juglans nigra*; 10 bushels Hickory—*Carya tomentosa*; 22 bushels Chestnuts—*Castanea vesca*; 1 bushel Larch—*Larix Europea*; 10 bushels Catalpa—*Catalpa syriacifolia*; 3 bushels Poplar—*Liriodendron tulipifera*; 3 bushels Pecan—*Carya oliviformis*; 1 bushel White Oak Acorns—*Quercus alba*; $\frac{1}{2}$ bushel Italian Sumac. And of seedlings we set 2000 Eastern Catalpa, 5000 Western Catalpa, 75,000 Black Locust.

In 1877 we set out 10,000 Catalpa, 1000 White Ash—*Fraxinus*

Americana; 15,000 White Pine—*Pinus Strobus*; 1000 *Abies Douglasii*.

In 1879 we set out 40,000 *Catalpa Speciosa*, 1000 *Catalpa Japonica*, 150,000 *Catalpa bignonioides*, 10,000 *Ailanthus*, 3000 *Abies Douglasii*.

Since the last date, 1879, we have set a large number of *Catalpa*, and this winter will have about 100,000 seedlings to plant.

Now what has been the result? Much disappointment. But we do not despair of some success. I will relate our failures, and then the successes, if there be any.

We were first disappointed in the failure of the Black Locust plantations. The early groves reached a height of twelve feet, the later ones, of course, being less. The larger tracts forming most impressive studies. The trunks stocky, straight, and limbless, the upper branches all interlaced, forming a solid roof, the midday sun seldom reaching the alleys between the trees. They gave promise of a fine Locust forest, just such as we had pictured, but hardly expected to realize. Alas! one September the Locust Tree Borer—*Cycline picta*—mysteriously descended in swarms upon our typical Locust groves, laying millions of eggs, which produced myriads of grubs, which by the next midsummer had ruined every tree. We cut the trees down and pulled out the roots by oxen, the expenses of removal being \$25 per acre. We were done with the Locust.

A description of the Locust Tree Borer may be interesting. The mature insect is found in the locust tree in August and September, the eggs being deposited then in crevices of the bark, and hatching in ten days, when the grubs burrow into the soft skin or outer bark, where they remain in a torpid state during winter. In the spring they bore deeply, penetrating the hard wood of the branches and trunk, the passage being one-quarter of an inch in diameter, and sometimes a foot in length, and always upward—presumably to guard against the entrance of rain. The larva then becomes a pupa, when in about two weeks it emerges as a perfect insect, three-quarters of an inch in length, and in a gorgeous livery of black and gold. Limbs and branches suffering from the attack of this Borer become distorted by swollen growths of unhealthy wood—efforts of the tree to repair the injury. Nothing will serve, however; the injury is done, and the limbs gradually break away till the tree stands a dilapidated wreck.

Next the Swiss or Scotch Larch gave out, piping of the trunks, the main stem breaking off at about twelve feet in height. It did not promise well at any time, this tree doing best upon dry, rocky soils; ours was a sand with clay subsoil.

The next failure was with the Southern Deciduous Cypress. It disappointed us except in wet bottoms, so that we struck it off the list.

Of Hickory and Pecan, the nuts planted were, to a large extent, stolen by the squirrels, woodchucks and field mice, and those that did vegetate made such slow growth that we ploughed them out, and replanted the ground with Catalpa.

The Tulip Poplar was not a success, as the rabbits and field mice during winter ate off from the tender seedling the sweet juicy bark, and destroyed nearly every plant.

The White Oak Acorns were largely stolen by squirrels, woodchucks, rabbits and field mice, which ate the bark of the young seedlings, as they did of the poplar.

The Italian Sumac, planted for its leaves, still stands, but the percentage of tannic acid in its foliage is not greater than in the leaves of the Wild Virginia Sumac. So its cultivation does not offer much hope of profit.

Thus we have failed with Black Locusts, and Deciduous Cypress, Scotch Larch, Hickory, Pecan, Tulip Poplar, Oak, Maclura, Wild Black Cherry, Ailanthus, Ash, Mulberry, and some others.

Our successes have been principally in determining which varieties were not profitable to plant. Certainly, in this respect, we prospered famously. Our other successes, such as they are, have been achieved with four trees: Catalpa, Black Walnut, White Pine, Douglas Fir. Two deciduous trees, and two evergreen, and the two deciduous might be reduced to one, the Catalpa. Of this, the Catalpa, we have abandoned several tracts, and after most serious ravages by stray cows, half-wild pigs, rabbits, squirrels, mice and fire, have about 200,000 trees, ranging in height from two to twenty feet, according to the period of planting. They stand in rows six feet apart, many of the rows a quarter of a mile long, and promise to make, in time, fine forest studies if not eaten up, for the Catalpa has its insect enemies as well as other trees. Two years ago every tree was denuded of its leaves within a period of a month, by the ravages of the Catalpa Sphinx—*Daremma Catalpæ*. They have gone, but they may come

again, and may stay with us. Still, this contingency of destruction by insects unavoidably attaches to the culture of any forest tree. To describe the Catalpa, I will say that there are two types cultivated for forest purposes, the Eastern and the Western (indicated botanically as the *Bignonioides*, and the *Speciosa*—) the latter, the Western, being most approved.

The tree is hardy as a Chestnut, of quick growth, the trunk and limbs, by reason of its resistance to decay, being valuable for fence posts, gate posts, and mudsills. I have a piece of gate post which stood in place one hundred years, and it is in a perfect state of preservation. The timber when sawn takes a fine polish and is handsomely marked in its cellular structure. The Catalpa has been used in the West for railroad ties, and possibly it makes serviceable ones. By some forestry writers it has been extolled as superior to the White Oak, but that is nonsense. Certainly these enthusiasts do not understand that a first-class tie must have other merits than resistance to decay engendered by moisture. The Catalpa tie is deficient in resistance to the hammering of the rail under passing trains, and it is deficient in that adhesive power upon railroad spikes possessed by the White Oak or Chestnut. In Oak very careful tests have proven that as much as a pull of 4000 pounds is required to draw out a spike driven 5½ inches. In the Catalpa the adhesive power is not one-half of 4000 pounds.

The second variety of deciduous tree which we have planted in large number is the Black Walnut—*Juglans nigra*. In tidewater Virginia it is found wild and of noble proportions. Our seedlings, however, have grown very slowly. For the first six or seven years they grow but a little more than four inches a year, and it is only when they become very deeply rooted that they appear to start off vigorously. The lowland soils, however, are not adapted to the development of the best Walnut timber, the wood produced there being too full of silex. It will not polish as smoothly as timber grown upon a soft prairie soil. It is stronger and better adapted for the legs and rounded portions of furniture, but as a rule does not furnish handsome paneling.

Our Walnuts, of which we have 150,000 trees left, after as many have been destroyed and others abandoned, do not impress us as of much value, and for the present we will not plant any more.

Turning to the evergreen family, we have of White Pine 14,000, a fine block of trees 12 to 15 feet high, and now growing at the rate of two and three feet a year, quite as rapidly as the native Loblolly Pine. Our attention was directed to the White Pine as flourishing upon our particular soil by a wild settlement of this tree in the midst of one of our Yellow Pine forests. Here we found a parent tree, 90 feet high, grown probably from a seed dropped by a bird of passage, possibly from far-off Maine. It has germinated, reached maturity, and developed seed, which falling around, had in turn germinated and developed seed-bearing trees, till now the growth of many generations of trees stand in concentric circles, this natural group clearly indicating the adaptability of the soil and climate. This example, and the results of our own plantations, make it quite evident that the White Pine can be grown very successfully, the principal difficulty being in securing a stand in the first instance, as a large percentage of the seedlings die.

As the Catalpa is the best of the deciduous trees, I think the Douglas Fir is the best of the two evergreens; it is equally as rapid in growth as the White Pine, and if it reaches maturity and escapes the ills of forest life, it will be more valuable, one of its merits being in its early maturity; its long tapering and light wood trunk particularly suiting it for ship spars, while on the other hand older trees reach vast proportions, and form a trunk far surpassing the White Pine of Maine. *Abies Douglasii* for Eastern plantations should be grown from Colorado seed, as the Oregon type is not so hardy. I would recommend that the White Pine or the Douglas Fir be planted in alternate rows, so that in case of destruction of either variety by insect depredations or soil influences, there may be the chance of the remaining variety reaching maturity. Indeed, all plantations should be mixed, for the same reason, but they must be mixed judiciously.

After Eighteen years of practical forest planting on a small scale I conclude that for the particular region of tidewater Virginia, and I think I may venture to say as well for tidewater Delaware, Maryland and North Carolina, there are only four trees to plant; and I conclude, also, that it is very questionable if it be profitable in that region to plant at all, so long as the wild Pine will spring up in every field just as soon as annual cultivation ceases. How the seeds get there I do not know, for they will spring up in the centre of a one hundred acre field simultaneously with their ap-

pearance upon its tree-fringed borders. This Pine will start without plowing, and it will grow under the most adverse circumstances. It will take care of itself in spite of wild hogs and stray cattle. Fire is its enemy. In twenty years it will make 20 cords of brick-yard wood to the acre, and for every year thereafter an additional cord or more till at forty years it will cut 50 cords of first-class wood, the only expenses being the taxes, which, State and county together, do not equal *one-half of one per cent.*

I do not want to discourage any one; I have related personal experience, and in a special section. No doubt the same conclusions will apply all the way down from the Potomac to Florida, but we never expected to see Forestry practiced upon the Southern seaboard.

The climatic and soil conditions upon the mountains of Pennsylvania, and in other regions of altitude in the various States, are different from what I have met with in my Virginia experience, and in each case the system of administration has to be considered separately; and here is a feature which I would like to emphasize, the necessity of a close study of climate, soil, and local influences, both as respects the State and locality, and as respects the area of ground to be planted. These influences must be understood first or last, to insure success. Forest plantations in every untried district must necessarily be experimental. The planter must take many chances, for even if the natural growth of trees of the section indicate success with certain varieties, still, the planter may locate them with bad exposure, with respect to subsoil, with respect to drainage, with respect to shelter from injurious winds. The grain farmer who experiments with an untried crop, and by reason of an uncongenial soil, insect ravages or other physical causes, fails to make a crop, only loses one year's labor and expense. He can try something else the next season. Not so with the forest tree planter; if he makes a mistake, he only finds it out after a term of years, not less than ten—it may be after twenty years he finds he has to tear out and plant over.

The comprehensiveness and scientific detail of this subject of forestry is so well understood in Europe that the Forestry Schools are under the especial patronage of the Governments, and they turn out annually a force of foresters whose education is as practical and thorough as that of any class of collegians.

We should have a United States Forestry School as well as a Military Academy. West Point is a noble educational establishment; it is worth much more than its annual cost of \$350,000; but we need a highly educated class of Foresters, to look after the National domain, just as badly as we need military officers.

To enumerate the attainments of thoroughly educated Foresters, I will say they should be botanists, quick to recognize fungi preying upon living trees and cut lumber, and to understand how to adapt palliative measures at least, if not entirely to arrest its extension—for example, the chestnut railroad tie has eight distinctly named species of fungi common to it. Foresters should be vegetable physiologists, to familiarize themselves with the structural development of trees and their sustentation. They should be entomologists, to recognize the insects which prey upon trees, and provide measures for their destruction. They should be ornithologists, to aid and protect the birds which feed upon the destructive insects. They should be geologists, to understand practically and scientifically the composition of soils. They should be meteorologists, to study the practical condition of rainfall, temperature, wind and exposure. They should be agriculturists, to understand the working of land. They should be wood cutters, mechanics and engineers, to fell the tree, to dam streams, to locate mills, to drain water, to establish water preserves, to erect barriers to arrest snow-slides, land-slides, shifting sands; to erect machinery to saw lumber. They should be merchants, to cut with judgment, to cut the right tree at the right time, and market profitably. Thus, it will be perceived, the subject is a deep one.

The matter of insect ravages alone is a most interesting and important study, for when we consider that the Hickory has eighty-seven distinctly recognized and named insects feeding upon its roots, its hardwood, its bark, leaves, flowers and seeds, and that the Pine has one hundred and two, and that the Oak of this country has two hundred and one, the wonder is that a tree ever reaches maturity.

Philadelphia, January, 1889.

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